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ECOLOGY AND POPULATION DYNAMICS OF FALLOW DEER (DAMA DAMA)
IN
LAND BETWEEN THE LAKES, KENTUCKY

Prepared By

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INTRODUCTION

Fallow deer belong to the genus Dama which is placed in the Order Artiodactyla, Family Cervidae, Sub-Family Cervinae (Christie and Andrews 1966); the peculiar shape of antlers "which flatten or palmate like those of the moose, but usually only to a width of three or four inches, rarely as much as eight inches" is the basis for placing these in a genus distinct from Cervus (Cahalane 1939:500). The fallow deer (Dama dama) is a relative of the now extinct Giant Irish deer (Megaceros gigantea) which once inhabited the British Isles (Whitehead 1950). The original range of the fallow deer included the Mediterranean region of southern Europe and Asia Minor (Cahalane 1939, Walker 1964). However, the species was introduced into England by Romans almost 20 centuries ago (Cahalane 1939). Further introductions took place throughout the Baltic countries, Australia, New Zealand, and a few areas in the United States (Bentley 1957, Walker 1964).

Six known introductions of fallow deer have been made in the United States. Between 1930 and 1936, 500 to 600 fallow deer were introduced in the area which is now the Aransas National Wildlife Refuge in Texas (Halloran and Howard 1956). The Refuge is a sandy peninsula reflecting a blackjack oak (Quercus marilandica) and live oak (Q. virginiana) savanna with grasses ranging from "coastal sacahuiste on the lowest flats to bluestems, dropseeds, muhlies, and artistidas in the higher-portions" (Halloran and Howard 1956:460). By 1938, only about 22 fallow deer survived; and, they were last recorded on the Aransas Refuge in 1941. Packard (1955) reported that 60 white fallow deer were released in Nebraska in the late 1930's on the southeastern edge of the sandhills in Boone County. The habitat consisted of "extensive hay fields, good willow growths, and some corn fields" (Packard 1955:471). An aerial census in 1958 indicated 105 fallow deer on the area; there was no substantial change in the population from 1958 to 1965 (Havel and Menzel 1966). Butcher (1955) reported six white fallow deer in pens on the French Creek Game Farm, West Virginia; these introductions were made in January 1950. There are presently no fallow deer living under wild conditions in West Virginia (personal communication, 1967, J. M. Ruckel, Assistant Chief, Game Management, West Virginia Dept. of Natural Resources, Charleston). Flyger (1959) reported a herd of fallow deer on Mills Island in Chincoteague Bay, Maryland; however, the origin of the herd was unknown. A herd of approximately 125 to 150 fallow deer, believed to have resulted from the original release of seven deer in 1936, is present on the Argonne National Laboratory in northeastern Illinois (personal communication, 1967, R. Brand, Argonne National Laboratory, Argonne).

The largest and most stable herd of fallow deer in the United States is located between Barkley and Kentucky Lakes [Land Between the Lakes (LBL)] in western Kentucky. LBL is a 170,000-acre peninsula being developed by the Tennessee Valley Authority (TVA) for public recreation and conservation education. The herd apparently originated from the release of about 20 deer in 1918 (personal communication, 1966, Dr. R. Nall, Staff Biologist, LBL); about 30 white-tailed deer (Odocoileus virginianus) were released at the same time.

There is increased interest in introducing exotic species into the United States to fill unstocked or understocked habitats and for game ranching purposes (Bump 1968, Texas Chapter of the Wildlife Society 1968).

The fallow deer herd in Kentucky presented a unique opportunity to study an exotic species that appears to have become established and which has the potential of competing with a native species. Since most introductions of the fallow deer in the United States have failed or barely maintained their numbers, it seemed worthwhile to attempt identification of those conditions that led to success in Kentucky.

Objectives

The primary objective of the research was to study habitat utilization, spatial requirements including dispersal, and social behavior, especially as related to the population dynamics of fallow deer. Secondarily, other biological parameters such as life history, and competition between fallow and white-tailed deer were investigated. Research was conducted from 1 November 1970 through 31 August 1973.

Study Area

The study area was centered on land, formerly the Kentucky Woodland National Wildlife Refuge, presently called the Conservation Education Center (CEC). This area had no legal hunting and good access; and, the central part had the highest population of fallow deer in the entire LBL area along with an established population of white-tailed deer. The most prevalent vegetative type was woodland composed of typical second-growth southern oak-hickory (*Quercus falcata*-*Carya* sp.) associations (personal communication, 1966, Dr. R. Nall). Meadows supporting dense stands of fescue and other cultivated grasses and legumes along with mixed stands of bluestem grasses and perennial herbaceous species were numerous. The topography of the area included rough, rolling uplands with numerous steep hillsides and bluffs; elevations varied from 365 to 500 feet. The area was not glaciated, the soils being derived mainly from shallow loess over extensive gravel and chert beds. Remains of alluvial deposits of clay, silt, and gravel were visible along the higher elevations of some hills. The average mean maximum and minimum temperatures for January and July, 1931 to 1952, were as follows: January - maximum 47°F, minimum 29°F; July - maximum 91°F, minimum 67°F. The average annual precipitation over 21 years was 48 inches.

METHODS AND MATERIALS

Capturing and Marking

As many fallow deer as possible and several white-tailed deer were captured and individually marked each year from trapping sites located at Empire Farm, Center Station, and Barnes Hollow. Deer were captured in groups with the proven method of cannon-netting (Hawkins et al. 1966, Hawkins et al. 1967, Hawkins et al. 1968). All deer were marked with a numbered metal eartag. Thermoplastic collars (Boltaron) of black, red, and green with silver reflective symbols to identify individuals were placed on all does. Bucks received expansible, numbered collars made from alternating 3- x 3-inch blocks of Boltaron with 2-inch sections of nylon elastic, or neck straps of elastic having pendant Boltaron squares with reflective 4-inch high identifying numbers. In addition, bucks were marked with earstreamers and eartags; most also received a tattoo on one ear. An attempt was made to radio-mark at least three of each sex and age class (adult male, adult female, yearling male, yearling female, male fawn, and female fawn) each year with 148 MHz transmitters. All deer were aged according to Severinghaus (1949).

Radio-tracking

Habitat utilization, movements, and to a lesser extent, social affinities were derived by daily location of radio-marked deer with an 11-channel Model LA 11 receiver (AVM Instrument Co.) and a rotatable truck-mounted Model 28 Hy-Gain antenna. Radio-locations were obtained daily at random intervals.

Observations from Vehicle

Primarily, population trends and movements and, secondarily, habitat utilization and social relationships were determined by systematically driving roads on the study area and making observations of marked deer with a binocular and spotting scope. For all deer, location where seen, date, time of day, group size and composition, behavior, and habitat utilized were recorded. Observations of any behaviorisms such as antler rubbing and whipping and lashing shrubs which may be used in establishing territories (Graf 1956) were recorded.

Miscellaneous Observations

Although this was primarily a study of fallow deer, observations of white-tailed deer were recorded so that comparisons could be made between the species regarding direct conflict and competition for available resources. Considerable miscellaneous biological data such as weight, blood samples to analyze for diseases, and external parasites were collected. A series of known-age jaws were collected from mortalities to check the adaptibility of the Severinghaus (1949) method of aging white-tailed deer for use on fallow deer. Most mortalities of fallow deer such as roadkills were skeletonized, and the internal organs saved. Weights and measurements of these will be compared among age classes of fallow deer and with other species, especially white-tailed deer. Data on dispersal was gathered from hunter harvests and analysis of roadkilled deer, as well as from radio-tracking.

Data Analyses

All data were placed on IBM scanner sheets and analyzed on an IBM 370 computer. Locations of deer were recorded by an X-Y coordinate system to allow the following computer analyses: (1) mean activity radii by sex and age class by month, (2) centers of activity by sex and age class by month, (3) distances between centers of activity of related deer during various periods, and (4) mean maximum movements by sex and age class by month. Other parameters computer-analyzed included: (1) frequencies of associations, (2) habitat utilization, (3) correlation of habitat and behavior, and (4) modal group size and composition by month. Analysis of variance and the student's t-test were utilized in data comparison. Unless otherwise cited, tests of significance were at $P<0.05$.

RESULTS AND DISCUSSION

A total of 391 deer (357 fallow deer, 34 white-tailed deer) were captured and marked from February 1968 through August 1973; this total includes the 134 animals marked by Dr. R. Nall and his staff. Appendices A, B, and C list those animals captured during 1971 through 1973. Thirty-four of the captured deer were radio-marked. The radio-marked animals included 5 adult males, 11 adult females (2 white-tailed), 3 yearling males, 3 yearling females, 8 male fawns, and 4 female fawns. During the research, 8,406 individual observations were made.

Life History

Fallow deer represent one of the most attractive deer families (Christie and Andrews 1966) and have been kept in European parks for centuries (Cadman 1966). They were very numerous in Britain in the times of the Normans and were highly regarded as "beasts of the chase" (Cadman 1966:3). The meat is variously rated as "palatable though not especially prized by hunters" (Christie and Andrews 1966:88), "high quality" (Cadman 1966:3), and the "best tasting of all venison" (Butcher 1955:13). Hunters in LBL vary in their opinions of meat quality.

Whitehead (1950) reported that in woodland country the fallow deer were very adept and had an amazing ability for avoiding the hunter; however, Flyger (1959) referred to the fallow deer as being vulnerable to hunting. In this study it appeared that the fallow was more vulnerable to the hunter than the white-tailed deer. Although quicker to run, the fallow deer did not run far and often stopped within rifle range; in addition, the white-tailed deer came into the open more cautiously than the fallow.

The fallow deer is about the size of the white-tailed deer (Butcher 1955) but has shorter legs and a heavier body (Flyger 1959). Also, the head is shorter and broader with shorter ears. Male fallow deer have very obvious penal sheaths with long hairs; females also have long hairs on the vagina. The most distinctive feature of fallow deer is the tail which is about 9 inches long, black on the top and sides and white underneath (Cadman 1966). Except for the black and the white fallows, the LBL deer have a black rump stripe. Their most highly developed sense is smell, and the least keen is eyesight (Cadman 1966).

Fallow deer have distinctive antlers, which develop progressively with age. Yearling males normally have 8-inch spikes arising from a swollen bulbous base; occasionally, a fork may develop. At 2 1/2 years of age, the antlers begin to branch with brow tines projecting in front. Deer in good condition at LBL will have small palms at 3 1/2 years and well-developed palms at 4 1/2 years; some English deer have palms at 2 1/2 years (Chaplin and White 1969). The antlers begin to deteriorate in quality when the animal reaches 8-10 years of age.

"The most common summer coloration . . . is bright fawn with white spots above the whitish underparts. The winter coat . . . is grayish fawn without the spots and lighter underparts" (Walker 1964:1,387). However, other color varieties include black, white, blue, sandy or cream, yellow dun, and dark dun (Whitehead 1950).

Five solid white individuals (two adult does, one yearling male, and two male fawns) were observed at LBL. No differences were noted in their behavior from "normal" colored fallows; however, three of the five white deer were killed suggesting that they may be more vulnerable than the other fallow deer to the hunt. Black fallow deer were also present in the study area and were more numerous than the white ones. One adult female (#75), a normal-colored deer, had black fawns each year during the study period. No black adult male was reported in the study area.

Whitehead (1950:161) described the voice of the fallow buck in the rutting season as a "husky rattling grunt"; Cadman (1966:5) referred to the rutting call as "groaning" which was a grunting, sometimes belching sound. Does utter a bark of alarm throughout the year; this bark is distinctive but infrequent (Whitehead 1950).

The "groaning" of mature males in LBL was repeated every 3-4 seconds for several hours unless the animal was disturbed. The sound carried at least one-half mile, and possibly further. When feeding, all deer, especially fawns, made a low soft sound which could not be heard for over 50 yards. Many of the animals produced this sound simultaneously.

The gait of the fallow deer is characteristic, appearing stilted or jerky; they run by jumping on all fours (Christie and Andrews 1966). If disturbed, the deer will "bounce" on all four legs for a short distance, stop, and then run again. Christie and Andrews (1966) reported fallow deer capable of jumping 7-foot obstacles with ease. Fallow deer bob their heads up and down when uneasy and stamp their front feet when nervous (Whitehead 1950).

The fallow deer in LBL were reluctant to jump and were not as adept as the white-tailed deer. A horse pasture in the study area with a 4-foot fence was regularly used by white-tailed deer but infrequently by the fallows. Those fallows found inside the pasture ran along the fence instead of jumping over when pursued.

Cadman (1966:22) reported the following peculiarity of fallow deer:

> During February and March the male fallow deer, which are still in male herds, often spend some time on their "play rings," especially during warm sunny afternoons. A play ring is usually made around some prominent feature such as a stump, or a rock, or isolated tree, around which the deer gather and chase each other, often anti-clockwise, sometimes kicking their heels in the air, and sometimes standing on their hind legs and boxing each other. The ground around these play rings is trampled bare of vegetation. The significance of this activity is not clearly understood . . . But the simple explanation is that it is just play . . . Play rings are also sometimes used in late August and September. Does and fawns also visit play rings.

Although play rings were present at LBL, they were not common. One was near the refuge headquarters around a solitary maple (Acer sp.) tree (18 in. diam.) in a grassy area. The play ring most utilized was in Barnes Hollow around an isolated black walnut (Juglans nigra), approximately 8-10 inches in diameter. The tree was in the open about 20 yards from the edge of the woods with a ring 6-7 feet in diameter around it. Most activity at the play rings occurred from late January to March. One group at the play ring consisted of male fawns with a few adult males watching but not participating. Three or four deer would run in a counter-clockwise direction; none were seen standing on their hind legs and boxing. This behavior did not appear to be antagonistic. No females were seen utilizing these areas. Possibly, this activity was part of a social hierarchy determination in males.

Fallow deer were more playful than the white-tails. When large groups of females and fawns were feeding in fields, one deer, usually a fawn, would suddenly bounce over to another, then make a long ellipse of 50-75 yards and return. During this procedure, the tail was held up and curved over the back. This activity would often start a "chain reaction" with several deer participating. Occasionally, as a fawn approached a doe, the doe would "slap" at the fawn with her front feet (she did not come up on her hind legs).

Observed Activities

Of 7,605 observations, 63.1 percent of the deer were seen feeding (Table 1); this was expected as their feeding activities were in the open areas. Moving, the second most frequently seen activity, was anticipated because of the animals' response to the investigator. About equal numbers of deer were observed standing and bedded. Only 0.3 percent were observed in play activity; drinking and courting each made up 0.1 percent of the total observations.

Reproduction

The rutting season began the first week in October. At this time the adult males with thickened and enlarged necks sought territories to defend. Isolated open areas ringed by brush and low, hanging branches were the choice locations. The bucks paraded up and down their territories, pausing occasionally to thrash the low branches and brush or to paw at the ground; they urinated on these scrapes and plastered themselves with mud (Cadman 1966). By mid-October, the breeding season was at its peak; and, most adult bucks had taken up a permanent stand. While on the stand, the bucks ate very little (Cadman 1966). Yearling bucks often remained near the stands but did not participate in rutting behavior. Often 10-12 does would feed near the stand but would not react to the breeding behavior of the buck. No bucks were seen chasing does while close to a stand nor were any receptive actions by does noted. However, at other times bucks were seen actively pursuing does. Cadman (1966) reported that actual breeding was rarely observed. "On rare occasions a buck may kill a doe. This appears to happen when the doe will not stand or if she has been served by another buck" (Cadman 1966:26).

Although some head pushing was observed, no fierce fighting was noted at LBL. However, many bucks brought into the hunter check station had antler wounds about the head.

Adult males began vocalizing during the second week of October at LBL and continued about 2 1/2 weeks. Bucks groaned mostly at night and early in the morning, although some groaning was heard throughout the day. One buck at Empire Farm groaned continuously for 3-4 hours a night during the peak of rutting activity. Only bucks with palmed antlers were heard groaning; yearling males did not participate. Usually bucks groaned only while on their stands; but one buck at Empire Farm groaned while following feeding groups of does. Rutting behavior tapered off sharply after October, but the bucks were seen to pursue doe fawns, which came into heat later, well into December.

Bucks were secretive after the rut for several weeks and then formed male herds, except for old bucks which often remained solitary (Cadman 1966). According to Whitehead (1950), a very definite social hierarchy developed in male herds and remained relatively stable.

Male herds started forming in early December in LBL and usually contained about six individuals. Of the six deer, two or three were over 3 years old, one or two were 2 1/2 years old, and one or two were yearlings.

At the end of April and during the first week of May, most bucks in the study area lost their antlers. One penned fallow buck dropped antlers on March 31. Fallow deer bucks retained antlers much longer than white-tailed bucks; in 1971-1972, the first white-tailed buck without antlers was observed on December 31, and no antlered white-tails were seen after early March. Antler regrowth began in June for fallows, and the antlers reached full growth by the end of July. The velvet was cleaned from the antlers by late August. At this time the bucks emerged from relative seclusion and associated in small herds. White-tailed buck groups began to separate at this time of year (Hawkins 1967, Hawkins and Klimstra 1970). By mid-September, the fallow bucks began to wander in preparation for the breeding season.

Most fawns were born during the 2-week period, mid-June through the end of June. Prior to the birth of the fawns, the females were secretive and remained alone. At LBL, many fawns were born in the open areas of power lines in sericea lespedeza (*Lespedeza cuneata*) from 1-2 feet tall and in grass and weeds. Some were probably dropped in open woods. Whitehead (1950) reported fawns born in fern or in beds of nettle. Following birth, the fallow does were usually seen alone for 7-10 days after which time they joined other does in feeding groups. Cadman (1966) noted this period to be only 2 or 3 days. Separation of does and fawns continued about 1 1/2 months until August. In contrast, white-tails generally remain separated for 2 or 3 months (Hawkins 1967).

Group Size and Composition

A unique characteristic of fallow deer at LBL was the tendency to form exceptionally large herds in the winter and spring. This grouping was always associated with a few areas of choice food habitat. At Empire Farm, Barnes Hollow, and Center Station, herds of 20-25 were frequent; groups of 40-50 were commonly seen at Barnes Hollow. Of all groups observed, herds of 10 or more accounted for 21.0 percent of the total in

March (Table 2); after this period the percentage decreased throughout the summer but increased again in the fall. Fawning and the wide availability of food contributed to the summer decrease in group size. Except for the large feeding herds, females and young remained separated from bucks. The typical group that traveled and bedded together included five to seven individuals; these were usually two adult females, one yearling female, and two fawns.

Modal group size of the fallow deer was calculated by month (Table 3). Group size remained at a constant of two except in April, May, June, and July. These groups of two had a mode of one female (adult or yearling) and one fawn (Table 4). The rise of the modal group size to three in April coincided with the period of fawn dispersal, of general wandering, and of antler loss. For groups of three, modal group composition was two females (adult and/or yearling) and one fawn (Table 4). May, June, and July had a modal group size of 1. In May, this single deer was usually a fawn (Table 5); the fact that fawns were the most commonly seen single deer March through May demonstrates the increased mobility and dispersal of fawns at this time of year. A female (adult or yearling) was the most commonly observed single deer during June and July; this coincided with the fawning period and also with the reclusive behavior of bucks during antler regrowth.

In August when fawns were strong enough to follow the does regularly, several does and fawns were commonly seen together. Cadman (1966) considered this the beginning of herd activity. These groups were unstable and did not maintain their integrity for any length of time. Although males were never included in the mode of groups of two or more, they did become the most frequently seen single fallow October through January, as a result of the greater mobility of the males in the breeding season and in the period of yearling dispersal.

Movement and Dispersal

Mean activity radii were calculated for sex and age classes by month from individuals observed five or more times (Fig. 1). Mean activity radii give an indication of the day-to-day movements within a home range. Data was generally lacking during the breeding season in September and October when all deer were reclusive; the one adult male and one adult female recorded both had a mean activity radii of approximately 0.1 mile.

Mean activity radii of adult and yearling males reflected similar patterns; radii of about 0.2 mile were maintained throughout the year until March when the radii of the two groups showed an increase to 0.8 and 0.7 mile, respectively. Adult and yearling males had the largest activity radii of all classes in March and April, the period of male herd formation and general wandering. It is interesting to note that mean activity radii of all sex and age classes were slightly less in February. This probably indicates that the deer were congregated in choice feeding habitats as previously mentioned. In July, male yearlings exhibited the lowest activity radii (0.1 mile) of any month and of any sex and age class. Hawkins (1967) hypothesized that reduced movement of yearling white-tails in the summer was due to an abundance of food which made extended travel unnecessary. A t-test revealed no significant differences ($P>0.05$) between adult and yearling males in any month.

Adult and yearling females followed the same pattern as the males except that (1) peak activity radii occurred in January, (2) the radii (0.2 and 0.4 mile, respectively) were smaller than the males, (3) the largest radii of female yearlings were twice that of adult females while the peak value of male yearlings was 0.1 mile less than adult males, and (4) while the yearling males exhibited the smallest activity radii in July, the yearling females had the highest value (0.3 mile).

The data on male and female fawns were combined as statistical tests yielded no significant differences (Table 6). The fawns also maintained a relatively stable mean activity radii throughout the year of 0.2 mile; but, these radii peaked in January and in March. High values in March might be explained by the tendency of the deer, especially the males, to wander and form groups. Possibly, movement of the females and fawns in January was a response to inclement weather and the need to travel greater distances in search of food. Data for fawns are missing from June through October because new fawns of the year were usually not captured and marked until November.

Statistical analyses revealed few significant differences between the sex and age classes (Table 6). Generally, males (fawns excluded) had significantly greater ($P<0.05$) activity radii than females in March and December. As expected, adult females moved less than adult males in March and June. A t-test showed that male and female yearlings differed significantly ($P<0.05$) only in the month of December. In March, the activity radii of fawns were significantly greater ($P<0.05$) than those of adult and yearling females.

Mean maximum movement was calculated to examine the tendency of any sex and age class to make long movements in any month (Table 7). Each individual was observed at least twice.

Adult males displayed a mean maximum movement of 1.2 miles for all months (Table 7). After the breeding season in September and October, there was increased movement which reached a climax of 2.4 miles in April.

At the end of April when antlers were dropped, their movement declined to a low of 0.3 mile. Movement was up again in June as males began to congregate, but declined steadily throughout the summer as the breeding season approached.

Movement values for yearling males were similar to those of adult males; however, the peaks and lows occurred in different months. The mean maximum movement of yearling males for all months was 1.1 mile; a high of 2.0 miles was found in November and a low of 0.4 mile in February and July. November was considered the month of greatest yearling dispersal. By December, movement had decreased, and it remained low until a new climax was exhibited throughout March, April, and May. While the adult bucks were in seclusion in May, the yearling males were more active; later in the spring as the adults again became active, the movement of yearlings decreased. No yearling males were observed in October.

Adult females maintained the lowest radii at 0.5 mile. Their greatest movement, 0.7 mile, occurred in January and April; a low of 0.3 mile was recorded in September. It appeared that adult females, after establishing themselves in an area, rarely move far from it.

The maximum movement of yearling females reflected a pattern similar to adult females but with slightly higher values in most months. A high of 1.2 miles in April and a low of 0.1 mile in October were recorded for yearling females. During the June fawning season, yearling females moved a maximum of 0.9 mile; and, adult females moved 0.5 mile.

Both male and female fawns maintained an average maximum movement of 0.7 mile. Male fawns gradually increased their movement from a low of 0.2 mile in November to a high of 1.0 mile in March and April; the movement dropped to 0.5 mile in May. Female fawns showed a relatively stable maximum movement until a peak in April of 1.1 mile. Their movement also dropped to 0.5 mile in May. Again, no fawns were marked between June and November.

Statistical tests revealed that most significant differences occurred in March and that most were differences between males and females (Table 8). Again, fawn data was combined. In March, June, and November, all males (fawns excluded) moved significantly greater ($P<0.05$) distances than all females. The March difference included both adult and yearling classes; only adults were statistically different in June. Although males were different from females collectively in November, no differences were detected in any one group. Adult males moved almost twice as far in June as yearling males; adult and yearling females were not different in any month. In March, the maximum movement of fawns was significantly greater ($P<0.05$) than adult and yearling females.

According to Nall (personal communication, 1967), fallow deer, until recently, had not spread in great numbers outside an area of about 10,000 acres, with the main area of concentration being in the vicinity of the old Kentucky Woodland National Wildlife Refuge headquarters; within this area fallow deer outnumber the reintroduced white-tailed deer. The latter have spread much farther and faster than the fallow deer. In the last few years since the human residents were moved out of LBL, fallows have appeared in new areas. This could be due to several factors: (1) less poaching in the area, (2) less disturbance by people, and(3) the destruction of favored bottomland by the damming of Barkley Lake. Also, in the last few years, the white-tailed population has built up around the old Refuge headquarters. Possibly, the habitat there is becoming less favorable for fallows than in the past. In Scotland, Batcheler (1960) concluded that the stage of growth of the forest habitat was more important than inter-specific competition in determining the relative abundance of fallow deer.

Any movement greater than 1.0 mile from the tagging site was considered dispersal (Robinette 1966). In LBL, dispersal for male fawns and, to a lesser degree, female fawns took place in April or May; about 10 percent did not disperse. Yearling bucks began dispersing in November; in 1972, 16 yearling bucks harvested had traveled an average 4.5 miles (range 1.5-8.2 miles) from the location where trapped (Table 9). These 16 bucks accounted for 35.5 percent of the available marked yearlings. Although yearling males emigrated more often than any other sex or age class, they did not always travel the greatest distances. Three yearling females harvested had moved an average 7.1 miles (range 2.5-13.7 miles). In March and April, all sex and age classes, but particularly the males, wandered extensively in search of food and in response to social pressure.

Home Range

Mean monthly home range was computed for 29 radio-marked deer (Table 10); the area enclosed by imaginary lines connecting all the outermost observation points was considered to be the home range (Mohr 1947). At the time of capture, these radio-marked deer included three adult males, nine adult females (two white-tailed), three yearling males, two yearling females, eight male fawns, and four female fawns. In the breeding period during September, October, and November, the deer were reclusive and difficult to track. As fawns were captured in November, and most radios were placed on fawns in March, little fawn data was obtained from June through December.

In general, adult males, yearling males, and male fawns occupied the greatest territory. Their largest home ranges occurred in March and were

645.3, 710.6, and 228.5 acres, respectively. Adult and yearling males inhabited the smallest regions in September. Home ranges of the three groups were not significantly different ($P>0.05$) in any month.

Adult females occupied the smallest area of any sex and age class; at no time did their home ranges exceed 80 acres. The largest home range of adult females was 75.0 acres in April; at this time, female fawns also showed their largest range which was 318.7 acres. Smallest home ranges for the two groups occurred in July (21.8 acres) and in May (34.5 acres), respectively. Yearling females utilized the most area (average of 247.0 acres) in July and August, probably due to group break-up at the fawning season, and the least in June (13.2 acres). Data for the two adult female white-tailed deer was available only for February, March, and April. Their home ranges averaged 81.7, 17.5, and 23.3 acres, respectively.

All males (fawns excluded) inhabited significantly larger ($P<0.05$) home ranges than females in February and March. Adult males and females differed significantly ($P<0.05$) in February and March; male and female fawns differed only in March. There were no significant differences ($P>0.05$) between adults and yearlings within either sex. In January and February, adult females occupied significantly smaller ($P<0.05$) home ranges than yearling males, and smaller than male fawns in March.

Frequency of Association

Frequency of association determines the extent of association among deer in certain time periods. Total observations were determined by adding (1) the number of observations of deer A alone, (2) the number of observations of deer B alone, and (3) the number of observations of deer A and B together. Frequency of association was then calculated by dividing all the observations of the pair together by the total observations (i.e., by the sum of 1, 2, and 3). Deer together 50 percent or more of the time during each time period were considered family members in white-tailed deer (Hawkins and Klimstra 1970).

Only seven pairs of does and fawns were associated more than 50 percent of the time in any one time period (Table 11). Four of the pairs had female fawns, and three included male fawns. Since most trapping began in November, no marked fawns were present from August through October. Closest association occurred in November and December as indicated by a frequency of association of 80.6 percent; associations decreased in the following months. Male fawns began to break away from their mothers in January, although still associated with them about 71.2 percent of the time, and form buck fawn groups. Often such groups contained 10-12 individuals; occasionally female fawns accompanied them. By February or March, the male fawns were associating with adult males. According to Cadman (1966), all sex and age classes wander during March and April in search of new plant growth. Of all single deer recorded in March, April, and May, most were fawns (Table 5). April and May marked the dispersal of fawns. After April 1972, only one fawn (a female) was recorded with her mother five or more times in any month. Two female fawns, #115 and #900, were seen 50 percent or more of the time with their mothers after they had become 1 year old. In the case of deer #115, the frequency of association dropped to 35.7 percent in June but rose to 50 percent and 100 percent in July and August, respectively. Fawns of the yearling females #102 and #180 did not remain with their mothers longer than the others.

Seven pairs of yearling and adult females were associated 50 percent or more of the time (Table 12). Three females (#89, #195, and #270) were closely associated in August 1973, the time when feeding groups of does and fawns were forming. Although it was not known if the yearling #270 was related to either adult, deer #89 and #270 had identical centers of activity that month. If a fawn accompanied any of the females in August, it was unmarked and hence was not individually identified. When deer #89 was a yearling, she associated with two adults, #94 and #107; the period of association was similar to that of fawns and does. It appeared that deer #89, #94, and #107 formed a relatively stable group for about 5 months; but, when #89 became 2 years old, she formed a new association with #195 and #270. Two adult females (#41 and #256) were together only in June and July; they probably occupied overlapping home ranges and fed together when separated from their fawns.

All male associations occurred in March and June (Table 13). Yearling male #155 associated with another yearling male (#90) in March, but by June, #155 was observed with the adult #237. Deer #90, in turn, spent about equal time with #155 and with #305, an adult. Similarly, adult #237 was associated with another adult #228, as well as #155, in June. The center of activity of the deer forming the June associations (#155 and #237, #228 and #237) was just west of Center Station. An area northeast of Bugg Springs Road was the center of activity for the associations (#155 and #90, #305 and #90) occurring in March. An unmarked adult male and deer #305 were seen together continually just after the rut and throughout the winter; however, more data would be necessary to determine significant social affinities.

Distance Between Centers of Activity

The center of activity, the geographic center of all observation points (Hayne 1949), was calculated by averaging all the X and Y coordinates separately for each animal. This point may or may not have biological significance for the individual. Distances between the centers of activity of related deer provided an indication of the extent of their original association and of their regrouping after the June break-up. Table 14 lists the distances between the mean centers of activity for six pairs of related fallow deer. Three periods of association between these deer were considered: adult-fawn, adult-yearling, and adult-adult. The average distance between does and doe fawns was 0.06 mile; does and buck fawns averaged 0.25 mile. A t-test showed no significant difference ($P>0.05$) between male and female fawn associations in any month or in all months combined. Data from three pairs of deer indicated that related fallow deer adults and yearlings were an average of 0.15 mile apart. When the offspring reached 2 years of age, this distance was 0.17 mile. Analysis of variance revealed no significant difference ($P>0.05$) between the three association periods.

All three of the buck fawns included in the doe-buck fawn associations were not recorded with their mothers after May. The last observations for two of the fawns were in May 1972; the third was last seen in August 1972. Apparently, these deer dispersed from the study area. At the present writing, none have been harvested.

Habitat Utilization

Cadman (1966) classified the fallow deer as basically a woodland species, preferring hardwood areas to coniferous forest, especially at high altitudes. The ideal habitat contained plantations in the thicket stage for daytime cover, and open woodland areas of hardwoods, or mixed conifers and hardwoods, with a ground layer of herbaceous and shrubby species (particularly brambles), all within the vicinity of pasture. Southern (1964) reported similar preferences by these deer. Fallow deer spend most of their time in cover at the edge of open areas (Cadman 1966).

In LBL, the fallow deer generally preferred open, grassy areas or areas planted to a crop such as wheat, although brush was utilized for bedding and hiding. In summer, areas of new plant growth, newly mown places (Kentucky bluegrass), and newly plowed regions were especially attractive. On cold winter days, the deer fed in the open but retreated to forested areas during periods of cold wind.

Fallow deer usually feed at dusk and dawn, although where undisturbed, they may become more diurnal, especially in winter (Christie and Andrews 1966). Their food consists of grass, young shoots, the leaves and bark of trees, chestnuts, acorns, crops, roots, green vegetables, and flowers (Vesey-Fitzgerald 1946).

The percentage of deer utilizing each habitat type by month was calculated (Table 15). Since most observations were made along roads and in open areas, data were biased to some extent. Herbaceous vegetation (brush, weeds and grasses) was utilized in at least 50 percent of the deer observations in all months except October, when agricultural crops became mature and mast crops were available. On a yearly basis, agricultural crops (wheat, corn, rye, and sorghum) were more extensively used than woodland areas; but, one must consider the observational bias. Other habitat types were utilized by less than 2.0 percent of the deer. Honeysuckle was separated from the other habitat types due to reports that this plant was being overbrowsed. In any month, the percentage of deer observed in honeysuckle never exceeded 0.3 percent. The distribution of deer at corn bait over the year was primarily a reflection of the periods of intensive trapping.

The number of deer observed in each habitat was correlated with time of day. To accommodate this analysis, the 24-hour day was divided into 4-hour periods; and, the percentage of deer using each habitat type in each time period was then calculated (Table 16). Herbaceous vegetation contained the largest percentage of deer at night. Cadman (1966) reported that, in areas of great disturbance, fallow deer feed in the evening and at night instead of at dusk and dawn. The use of the study area as an education center no doubt influenced this behavior. As expected, woods received most use in daylight hours; and, a greater percentage of deer were observed in agricultural crops during the day than at any other time. Most trapping took place in the 17 to 20-hour time period; hence, the larger percentage recorded at the corn bait pile. Deer were only observed near water in late morning. Although Cadman (1966) stated that fallow deer seldom drink, the great availability of water in the study area precluded any confirmation of this statement even though few deer were actually seen near water.

Since they reflect disturbances altering normal behavior, the activities of moving and standing were deleted in discussion. A clearer pattern of habitat versus behavior then emerges. Feeding and bedding, respectively, were the main activities observed in herbaceous vegetation, in agricultural crops, and in honeysuckle (Table 17). In the woods these two activities were reversed. As expected, 96.6 percent of the fallow deer seen at salt licks were feeding; all the deer observed near water were drinking. Grass along roads accounted for the large percentage

(45.1) of deer observed feeding in that habitat. All courting behavior was noted in herbaceous vegetation and in agricultural crops where herds often gathered to feed. Most play behavior was recorded in the woods.

Although to our knowledge the fallow deer has not been detrimental to the habitat of the study area or, for that matter, anywhere in the United States, this is not true for some other areas where it has been introduced. Lindemann (1956:68) reported:

> The fallow deer . . . introduced from the Mediterranean region about 1890, were particularly prone to debarking and browsing. They were unsuited to the Bialowies and degenerated in quality, becoming smaller and developing inferior antlers. On the other hand, they reproduced more rapidly than the native species and showed great mobility and tendency to spread. The resultant unrest in the area contributed to the decimation of the valuable red deer herd. Soon all species of the deer family began to show clear signs of degeneration . . .

Fallow deer have reached pest proportions and caused severe damage to the vegetation in certain parts of New Zealand and were declared "noxious animals" (Christie and Andrews 1966:87). Some 6,000 deer were killed by hunters in 2 years in one 20,000-acre block; in addition, the New Zealand Forest Service has used 1080 to control introduced deer (Daniel 1966).

There has been no evidence of severe habitat damage in LBL. Although the deer were not debarking trees, both fallow and white-tailed deer have eaten the tops of seedling pine trees. Honeysuckle was heavily browsed in some places; neither species was exclusively responsible for such browsing.

There had been reports of severe browsing in the Barnes Hollow area; it was feared that this activity was affecting the health of the fallows resident to that region. However, fawns trapped in Barnes Hollow and at Empire Farm averaged 71 and 68 lbs, respectively, in 1973.

No antagonism was observed between the fallow and the white-tailed deer in LBL. Although they did not socially group, they were often observed feeding in close proximity. Most such observations were in areas of choice feed such as new wheat, newly sprouted grass, or corn bait. Although there is abundant cover and water in LBL, there appeared to be some competition for food. It was impossible to say whether this rivalry was species vs. species or just deer vs. deer. The food competition between the two species was probably limited due to different preferences as fallow deer graze more than white-tails, while the latter eat more mast (Butcher 1955).

Population Dynamics

That portion of the Conservation Education Center (CEC) east of Bugg Springs Road (approximately 1,309 acres) was censused in November and December of 1971 and 1972; this area was chosen because it contained the highest concentration of marked deer. November and December were chosen because: (1) does were accompanied by fawns at this time of year, (2) determination of winter population allowed for evaluation of food supply, (3) this period came after the main rutting season and excluded breeding movements, (4) movement was more restricted on winter range, (5) buck fawns had not begun to group in large herds with older bucks or move out of the area, and (6) the fall loss of foliage provided better opportunity to observe deer. The population figures were determined by applying a simple ratio of marked deer to unmarked deer observed along the census route. During this 2-month period, 48 individually marked deer in 1971 and 51 marked deer in 1972 were observed and considered resident. Thus, the number of marked animals remained relatively constant both years, although additional deer were marked between counts. Dispersal, hunter harvest (deer which ranged in the CEC and adjoining hunting areas), natural mortality, and loss of markers were factors which contributed to the stabilized figure. The total number of deer observed and the number of marked deer observed were obtained from data gathered by driving the study area daily.

The following ratio was used:

$$\frac{\text{Number of marked deer observed}}{\text{Number of total deer observed}} = \frac{\text{Marked deer population}}{\text{Total deer population}}$$

Substituting the data for 1971 yielded the equation:

$$\frac{542}{2,058} = \frac{48}{X}$$

Solving for X gave a population estimated at 183 deer.

Similarly for 1972 the equation read:

$$\frac{467}{1,564} = \frac{51}{X}$$

When solved, X yielded a population estimate of 171 deer in 1972. This was equivalent to about one deer per 10 acres in both years.

Fallow does usually do not breed until about 28 months of age (Cadman 1966), and the life span is about 15 years (Walker 1964). The gestation period is 8 months; there is no delayed implantation as with the roe deer (*Capreolus capreolus*).

In 1971, three yearling females (#102, #180, and #325) in the study area had fawns; in most cases these fawns were smaller than those from adult does. One unmarked doe fawn that died after colliding with a fence was carrying a fetus. In 1972 and 1973, no lactating yearling females were brought into the hunter check station, and none were observed with fawns. About 41 percent of the white-tailed does on Crab Orchard National Wildlife Refuge in southern Illinois bred as fawns (6-8 months old) (Crawford 1959, Roseberry and Klimstra 1970). No twins were noted in LBL. Yearling males were apparently capable of breeding as evidenced by their swollen testes and by their behavior. In general, fallow deer appeared to have a lower reproductive potential that white-tailed deer.

Cadman (1966) reported wild, free-living fallow deer to be remarkably free from disease. Disease is unknown in New Zealand fallow deer; but, in a recent study, three nematode parasites were recorded from one host (Christie and Andrews 1966). In a survey for taeniid tapeworms in New Zealand, no Echinococcus granulosus was found, and Taeniahydatigena showed a 9 percent occurrence (Sweatman and Williams 1962). The LBL deer were heavily infested with Lone Star ticks around the oral and anal areas in late winter to early spring.

The physical condition of fallow deer in LBL had degenerated in 1972 and 1973. Backbones of the deer were prominent, and there was little fat reserve around the kidneys. In England, weight of wild male fallows ranged from 19 kg (41.9 lb) to 81 kg (178.4 lb) at time of death (Chaplin and White 1969). In LBL, calculation of mean weight at time of capture showed a statistically significant trend ($P<0.05$) toward reduced weight in males from 1971 to 1973 (Table 18). Analysis of variance revealed no such trend for the females. Male fallow deer of all age classes undergo more biological stress than females. During the breeding season, males fight to establish the social hierarchy and to defend the rutting stands; after their antlers drop and during the fawning season, males are harassed by the then dominant does. It follows then that the males are the first to show the effects of food shortages or habitat deterioration. Long et al. (1965) found similar phenomenon to occur in white-tailed males in Pennsylvania.

In nearly all cases, the white-tailed deer were heavier than the fallow (Table 18); this difference was significant only between adult and yearling females. Data for male adult and yearlings were limited in the white-tailed deer. Male white-tail fawns in 1973 at 71.6 lb were the only group lighter than the fallow deer which averaged 72.6 lb. Although not statistically different, white-tailed deer did show a weight decrease from 1972 to 1973 in all sex and age classes, while adult and yearling fallow does showed a slight increase.

This trend of poor deer condition in LBL was not limited to one region of the area but was a general situation. This deterioration may have resulted from the following: (1) failure of the mast crop, (2) decrease in the acreage of agricultural crops, and (3) the invasion and replacement of corn fields by Johnson grass.

Management

The primary goal of management of the fallow deer on LBL should be to produce a quality deer herd, including the big trophy males. It is probable that the adult male fallows are being overharvested. In Area 1, 40 fallow males with antlers three points or greater were taken in 1972; only 10 were taken in the same area in 1973. This decrease may be true of the fallow deer in general because of its lower reproductive potential compared with the white-tailed deer.

If this is the case the following management alternatives exist: (1) Hunts could be established on a species basis. This would allow flexibility in number of days hunted, bag limits and other mechanisms of the hunt. (2) Fallow deer could be hunted every other year or every third year. (3) Another alternative is to hunt the white-tail at a rate compatible with maintenance of the fallow deer herd. However, this would probably lead to overpopulation in the white-tails. Thus, periodically they would have to be overharvested to keep them in check.

The obvious disadvantage of the first two alternatives is that it is imperative that the hunter be able to distinguish between the species of deer. Duck hunters have been forced to learn to distinguish species of ducks, on the wing even; thus, this is not an insurmountable task with deer hunters. Law enforcement would have to be rigid to prevent fallow deer from being killed and left in the woods, although some of this will invariably happen anyway. Of the above alternatives, keeping the hunts separate with regard to species would appear to be more efficient; but it would require more man-hours to organize and administer. This system would allow more control over the harvest of bucks in order to improve their quality. Harvest of any bucks with visible antlers (3 inches long?) except palm-antlered ones could be made unlawful. Again, however, this would require a concentrated effort to enforce and may prove an impossible task.

Besides hunter manipulation, some things can be done to increase the carrying capacity of the area for fallow deer. For example, more areas could be cleared and planted to crops which would be available in winter, such as corn and wheat. The feasibility of planting certain legumes, such as lespedeza and clovers, should be investigated. Utility right-of-ways and other cleared areas should be kept clear of brush and planted to grass, such as fescue.

Besides management of fallow deer in hunting areas, there is the problem of management of the herd resident to the CEC area. Here the fallow deer predominates, and the population is quite high. This herd is probably to the point where it needs to be thinned. This will probably be required every few years in order to maintain a quality herd. More clear-ing and planting of winter food would be desirable here as well as in the hunted areas.

SUMMARY AND CONCLUSIONS

The research was conducted in the Conservation Education Center (CEC) section of Land Between the Lakes (LBL), Kentucky. Data collection and analysis covered the period from November 1970 through August 1973.

The primary objective of the research was to study habitat utilization, spatial requirements including dispersal, and social behavior, especially as they related to the population dynamics of fallow deer. Secondarily, other biological parameters, such as life history, and competition between fallow and white-tailed deer, were considered.

Observations of 391 marked deer (357 fallow deer and 34 white-tailed deer) totaled 8,406 over the research period. All data were placed on IBM scanner sheets and analyzed by an IBM 370 computer.

The main breeding season of the fallow deer occurred in October. During this month, movement of all sex and age classes was greatly restricted. After the breeding season, males associated in male herds; does and fawns formed their own groups. Modal group size from August through March remained at two, usually one female (adult or yearling) and one fawn. However, during the winter large feeding groups of 20 or more often formed. Typical groups traveling and bedding together consisted of five to seven individuals, commonly two adult females, one yearling female and two fawns. All sex and age classes, especially males and fawns, traveled extensively in March and April. Males lost their antlers about the last of April to the first of May and immediately went into seclusion. Antlers were regrown, but in the velvet, by July, at which time the males again formed male herds. Most fawns were born in June, and the does were secretive until the fawns were strong enough to follow their mothers. Thus, by August, separate herds of males and of females and fawns were again present. In September, the males separated and began wandering in search of rutting territories.

Mean activity radii and mean maximum movement indicated that males did more traveling than females in March, June, and November. Adult and yearling females were relatively stationary. Fawn dispersal took place in April and May; about 10 percent did not emigrate. Yearling bucks began dispersing in November. In 1972, 35.5 percent of the available marked yearling bucks had moved from the capture location and had been harvested.

The males generally occupied larger home ranges than the females. Males utilized the greatest area in March and the least in September. The largest home ranges of adult females and female fawns occurred in April; yearling females utilized the most area in July and August.

Frequency of association revealed seven pairs of related does and fawns, seven pairs of female associations, and four pairs of male associations. Most associations for the does and fawns occurred in November and December, with subsequent decline until final separation about April. Most of the yearling and adult female associations were in time periods similar to doe-fawn pairs; one pair was associated only in June and July. All the male associations occurred in March and June.

Distances between mean centers of activity of related fallow deer showed that the average distance between does and doe fawns was 0.06 mile. Does and male fawns were an average of 0.25 mile apart. A t-test revealed no significant difference between the two average distances. Related adult and yearling females were separated by an average 0.15 mile; when the offspring reached 2 years of age, this distance became 0.17 mile.

the peak value of male yearlings was 0.1 mile less than adult males, and (4) while the yearling males exhibited the smallest activity radii in July, the yearling females had the highest value (0.3 mile).

The data on male and female fawns were combined as statistical tests yielded no significant differences (Table 6). The fawns also maintained a relatively stable mean activity radii throughout the year of 0.2 mile; but, these radii peaked in January and in March. High values in March might be explained by the tendency of the deer, especially the males, to wander and form groups. Possibly, movement of the females and fawns in January was a response to inclement weather and the need to travel greater distances in search of food. Data for fawns are missing from June through October because new fawns of the year were usually not captured and marked until November.

Statistical analyses revealed few significant differences between the sex and age classes (Table 6). Generally, males (fawns excluded) had significantly greater ($P<0.05$) activity radii than females in March and December. As expected, adult females moved less than adult males in March and June. A t-test showed that male and female yearlings differed significantly ($P<0.05$) only in the month of December. In March, the activity radii of fawns were significantly greater ($P<0.05$) than those of adult and yearling females.

Mean maximum movement was calculated to examine the tendency of any sex and age class to make long movements in any month (Table 7). Each individual was observed at least twice.

Adult males displayed a mean maximum movement of 1.2 miles for all months (Table 7). After the breeding season in September and October, there was increased movement which reached a climax of 2.4 miles in April.

Analysis of variance yielded no statistical difference between the three association periods of adult-fawn, adult-yearling, and adult-adult.

In LBL, the fallows generally preferred open, grassy areas or areas planted to some agricultural crop, although brush was required for bedding and hiding. Most fallows fed in the evening and at night. There has been no evidence of severe habitat damage. Fallow deer tended to graze more than the white-tailed deer, while the latter ate more mast.

Although fallow deer usually do not breed until 28 months of age, at least three females bred as yearlings in 1971. Yearling females were not observed with young in 1972 and 1973. Fallow deer have a life-span of about 15 years. In general, fallow deer have a lower reproductive potential than the white-tails.

A census was undertaken in November and December of 1971 and 1972 in that portion of the CEC east of Bugg Springs Road, about 1,309 acres. In both years, the estimated population was one deer per 10 acres.

Generally, the physical condition of the fallow deer declined in 1972 and 1973, but numbers of deer appeared to be relatively stable. Calculation of mean weight at time of capture showed a statistically significant trend toward reduced weight in males from 1971 to 1973. Analysis of variance revealed no such trend for female fallow deer.

Unfortunately, a 2-year study does not give definite data on population dynamics. The build-up of the white-tail population in areas of previous high fallow concentration may indicate a decline of the fallow deer herd. It appears that in years of good food supply the fallow do well, but in poor years their reproductive potential may prevent them from recovering as quickly as white-tailed deer. An attempt to increase the fallow herd to a number equal to or greater than the white-tailed deer could result in ultimate habitat destruction and deterioration of both species. At the present time, the only course of management seems to be the continued development of food areas and the reevaluation of the fallow deer hunt.

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Table 1. Number and percent of fallow deer observed in each activity, Land Between the Lakes, Kentucky.

Activity	Number of Deer Observed	Percent
Moving	1,315	17.3
Standing	450	5.9
Bedded	461	6.1
Feeding	4,805	63.1
Courting	11	0.1
Playing	21	0.3
Drinking	4	0.1
Others*	538	7.1
Total	7,605	100.0

*Part of the animals in the group were engaged in one type of activity while others were engaged in another type.

Table 2. Percent of fallow deer observed in each group size by month, Land Between the Lakes, Kentucky.

	Percent Observed Month											
Group Size	J	F	M	A	M	J	J	A	S	O	N	D
1	17.0	8.0	7.2	16.8	25.0	26.5	22.5	15.2	18.8	14.5	5.9	5.9
2	21.1	13.9	13.0	16.0	22.6	19.8	21.0	15.6	30.6	20.0	26.9	27.5
3	11.6	13.3	12.5	19.0	19.6	15.9	15.5	14.5	7.1	12.7	10.3	16.1
4	11.3	11.3	7.5	11.8	11.9	15.2	12.0	13.4	8.2	14.5	11.4	8.6
5	8.2	10.9	10.4	6.4	7.1	6.7	7.0	8.9	8.2	5.5	9.2	9.4
6	7.5	10.1	9.6	6.1	4.8	5.5	5.0	8.9	0.0	3.6	9.2	6.7
7	3.9	6.8	7.5	6.4	1.8	3.0	3.0	4.5	7.1	7.3	7.0	5.5
8	4.8	5.2	6.7	2.9	1.2	2.7	3.5	4.5	3.5	3.6	4.1	3.5
9	2.3	4.8	4.6	2.4	0.6	2.4	4.5	2.6	4.7	1.8	1.5	2.7
≥ 10	12.5	15.7	21.0	12.0	5.4	2.1	6.0	11.9	11.8	16.4	14.4	14.1
Total	100.2	100.0	100.0	99.8	100.0	99.8	100.0	100.0	100.0	99.9	99.9	100.0

Table 3. Modal group size of fallow deer by month, Land Between the Lakes, Kentucky.

Month	Number of Groups Observed	Modal Group Size
January	441	2
February	497	2
March	415	2
April	374	3
May	168	1
June	328	1
July	200	1
August	269	2
September	85	2
October	55	2
November	271	2
December	510	2

Table 4. Modal group composition of fallow deer in groups of 2, 3, 4, and 5 in three time periods, Land Between the Lakes, Kentucky.

Group Size	January - May			June - July			August - December		
	M*	F	f	M	F	f	M	F	f
2	0	1	1	0	2	0	0	1	1
3	0	2	1	0	3	0	0	2	1
4	0	2	2	0	4	0	0	2	2
	0	3	1**						
5	0	3	2	0	5	0	0	3	2

*M = adult and yearling males, F = adult and yearling females, and f = fawns.

**The group composition was bimodal.

Table 5. Modal composition of single fallow deer by month, Land Between the Lakes, Kentucky.

Month	Males	Females	Fawns
January	1	0	0
February	0	1	0
March	0	0	1
April	0	0	1
May	0	0	1
June	0	1	0
July	0	1	0
August	0	1	0
September	0	1	0
October	1	1*	0
November	1	0	0
December	1	1*	0

*The group composition was bimodal.

Table 6. Comparison of mean activity radii (miles) by month as based on 557 observations of fallow deer, Land Between the Lakes, Kentucky.

	Number of Individuals Compared											
	Month											
Comparison Made	J	F	M	A	M	J	J	A	S	O	N	D
Males x Females (Fawns Excluded)	11x34	11x42	12x53*	3x32	--	12x28	10x20	9x33	1x1	--	2x26	10x56*
Adult Males x Adult Females	6x30	5x33	6x43*	1x27	--	3x24*	4x15	1x23	1x1	--	--	6x49
Yearling Males x Yearling Females	5x4	6x9	6x10	2x5	--	9x4	6x5	8x10	--	--	2x6	4x7*
Fawn Males x Fawn Females	9x5	27x6	31x13	25x7	4x1	--	--	--	--	--	1x1	7x2
Adult Females x Yearling Females	30x4	33x9	43x10	27x5	8x3	24x4	15x5	23x10	--	--	20x6	49x7
Adult Males x Yearling Males	6x5	5x6	6x6	1x2	--	3x9	4x6	1x8	--	--	--	6x4
Adult Females x Yearling Males	30x5	33x6	43x6	27x2	--	24x9	15x6*	23x8	--	--	20x2	49x4
Adult Females x Fawns	30x14	33x33	43x44*	27x32	8x5	--	--	--	--	--	20x2	49x9
Yearling Females x Fawns	4x14	9x33	10x44*	5x32	3x5	--	--	--	--	--	6x2	7x9

*A t-test showed the items compared to be significantly different at the 0.05 level.

Table 7. Mean maximum movement (miles) by sex and age class by month as based on 1,309 observations of fallow deer, Land Between the Lakes, Kentucky.

	Fawns		Yearlings		Adults	
Month	Male	Female	Male	Female	Male	Female
January	0.9	0.7	0.9	1.1	0.6	0.7
February	0.7	0.7	0.4	0.6	0.8	0.5
March	1.0	0.7	1.8	0.5	1.8	0.6
April	1.0	1.1	1.7	1.2	2.4	0.7
May	0.5	0.5	1.9	0.4	0.3	0.5
June	--	--	0.9	0.9	1.6	0.5
July	--	--	0.4	0.6	1.5	0.4
August	--	--	0.7	0.7	0.9	0.6
September	--	--	0.7	0.2	0.4	0.3
October	--	--	--	0.1	2.4	0.4
November	0.2	0.5	2.0	0.7	0.6	0.5
December	0.4	0.6	0.7	1.1	1.1	0.6
Mean Average	0.7	0.7	1.1	0.7	1.2	0.5
Total Observations	215	95	111	145	71	672

Table 8. Comparison of mean maximum movement (miles) by month as based on 1,309 observations of fallow deer, Land Between the Lakes, Kentucky.

	Number of Individuals Compared											
	Month											
Comparisons Made	J	F	M	A	M	J	J	A	S	O	N	D
Males x Females (Fawns Excluded)	13x65	19x83	20x105*	14x82	7x43	29x81*	23x77	24x84	7x25	1x20	9x64*	16x88
Adult Males x Adult Females	7x54	10x71	9x84*	6x68	4x34	5x66*	5x64	5x68	4x23	1x17	4x50	11x73
Yearling Males x Yearling Females	6x11	9x12	11x21*	8x14	3x9	24x15	18x13	19x16	3x2	--	5x14	5x15
Fawn Males x Fawn Females	18x8	44x21	69x24	49x21	23x12	--	--	--	--	--	3x3	9x6
Adult Females x Yearling Females	54x11	71x12	84x21	68x14	34x9	66x15	64x13	68x16	23x2	17x3	50x14	73x15
Adult Males x Yearling Males	7x6	10x9	9x11	6x8	4x3	5x24*	5x18	5x19	4x3	--	4x5	11x5
Adult Females x Yearling Males	54x6	71x9	84x11*	68x8	34x3	66x24*	64x18	68x19	23x3	--	50x5	73x5
Adult Females x Fawns	54x26	71x65	84x93*	68x70	34x35	--	--	--	--	--	50x6	73x15
Yearling Females x Fawns	11x26	12x65	21x93*	14x70	9x35	--	--	--	--	--	14x6	15x15

*A t-test showed the items compared to be significantly different at the 0.05 level.

Table 9. Distance moved (miles) by marked fallow deer killed by gun and bow hunters, Land Between the Lakes, Kentucky, 1972.

Collar Number	Sex	Age (when killed)	Distance Moved (Miles)	Date Killed
YEL	M	1 1/2	5.2	10-14-72
04D	M	1 1/2	8.2	10-14-72
610	F	4 1/2	7.0	10-14-72
04F	M	1 1/2	--	10-15-72
01V	M	1 1/2	5.3	11-1-72
03M	F	1 1/2	5.1	10-16-72
0WR	M	1 1/2	1.5	10-16-72
03G	F	5 1/2	3.8	10-20-72
01X	M	1 1/2	4.2	10-28-72
02E	F	6 1/2+	1.7	12-2-72
010	F	3 1/2	9.1	12-1-72
06V	M	1 1/2	5.1	12-2-72
090	M	2 1/2	5.3	12-2-72
06B	M	3 1/2	1.7	11-18-72
06L	M	1 1/2	4.2	11-17-72
02S	F	2 1/2	4.9	12-1-72
02A	F	5 1/2+	1.9	12-1-72
02L	F	1 1/2	2.5	12-1-72
160	M	1 1/2	4.0	11-27-72
079	F	5 1/2	2.9	11-27-72

Table 9. Continued

Collar Number	Sex	Age (when killed)	Distance Moved (Miles)	Date Killed
660	M	4 1/2	5.1	11-17-72
04N	M	1 1/2	7.8	10-17-72
03Y	F	1 1/2	13.7	11-14-72
04W	M	1 1/2	5.9	11-26-72
099	F	4 1/2	3.4	11-17-72
01W	M	1 1/2	2.9	11-27-72
04C	M	1 1/2	1.5	10-17-72

Table 10. Summary of mean monthly range (acres) of 29 radio-marked fallow deer, Land Between the Lakes, 1971-1973.

	Sex and Age Class					
Month	AM[a]	AF	YM	YF	mf	ff
January	226.1(4)[b]	38.9(5)	220.3(2)	171.7(1)	58.0(1)	39.2(2)
February	178.2(2)	31.0(11)	111.7(2)	44.8(2)	67.5(1)	34.7(2)
March	645.3(6)	50.8(11)	710.6(3)	60.3(3)	228.5(7)	52.5(4)
April	1,383.1(1)	75.0(7)	44.7(2)	35.5(2)	172.4(5)	318.7(3)
May	--	38.8(4)	107.5(1)	36.3(2)	27.8(1)	34.5(2)
June	149.7(3)	29.6(11)	55.2(2)	13.2(4)	--	--
July	326.3(3)	21.8(7)	14.0(3)	212.9(2)	--	--
August	142.4(2)	31.8(11)	260.5(1)	295.1(4)	--	--
September	36.9(1)	--	12.2(1)	--	--	--
October	148.8(1)	--	--	0.3(1)	--	--
November	--	37.0(8)	240.7(1)	58.2(1)	--	86.4(1)
December	470.9(4)	55.5(10)	143.4(2)	52.9(3)	6.4(1)	85.2(2)

[a] AM = adult male, AF = adult female, YM = yearling male, YF = yearling female, mf = male fawn, and ff = female fawn.

[b] Number of deer radio-marked to establish home range is shown in parenthesis.

Table 11. Frequency of association (percent) of fallow does with their fawns, Land Between the Lakes, November 1971 to August 1973.

Marked Members	Time Period	Total Observations	Percent of Observations Together
75 (AF)*514(Ff)**	11/71	17	70.6
	12/71	22	81.8
	1/72	24	41.7
	2/72	11	45.5
	3/72	13	46.2
88(AF) 900(Ff)	2/71	2	100.0
	2/72	11	90.9
0(AF) 115(Ff)	12/71	11	81.8
	1/72	13	46.2
	2/72	11	45.5
	3/72	11	54.5
	4/72	19	63.2
	5/72	5	60.0
	6/72	14	35.7
	7/72	2	50.0
	8/72	7	100.0
102(AF) 268(Ff)	3/73	10	60.0
102(YF) 66(Mf)	12/71	22	86.4
	1/72	18	83.3
	2/72	25	32.0
	3/72	24	20.8
	4/72	30	20.0
117(AF) 67(Mf)	12/71	19	84.2
	1/72	27	70.4
	2/72	17	52.9
	3/72	11	54.5
	4/72	19	10.5

Table 11. Continued

Marked Members	Time Period	Total Observations	Percent of Observations Together
180(YF) 513(Mf)	11/71	8	87.5
	12/71	18	72.2
	1/72	20	60.0
	2/72	13	61.5
	3/72	18	44.4

*AF = adult female, Ff = female fawn, YF = yearling female and Mf = male fawn.
**Fawns were considered yearlings on June 1.

Table 12. Frequency of association (percent) of fallow does, Land Between the Lakes, November 1971 to August 1973.

Marked Deer	Time Period	Total Observations	Percent of Observations Together
270(YF)*195(AF)	8/73	9	77.8
89(AF) 270(YF)	8/73	8	100.0
89(AF) 195(AF)	8/73	10	60.0
89(YF) 94(AF)	12/71	29	51.7
89(YF) 107(AF)	11/71	19	47.4
	12/71	29	51.7
	1/72	23	56.5
	2/72	17	70.6
	3/72	23	34.8
94(AF) 107(AF)	11/71	20	35.0
	12/71	29	51.7
	1/72	23	43.5
	2/72	22	9.1
	3/72	21	42.9
41(AF) 256(AF)	7/72	8	75.0
	6/73	11	54.5

*YF = yearling female, and AF = adult female.

Table 13. Frequency of association (percent) of fallow bucks, Land Between the Lakes, November 1971 to August 1973.

Marked Deer	Time Period	Total Observations	Percent of Observations Together
155(YM)*90(YM)	3/72	24	50.0
155(YM) 237(AM)	6/72	27	59.3
90(YM) 305(AM)	3/72	26	53.8
237(AM) 228(AM)	6/72	26	76.9

*YM = yearling male, and AM = adult male.

Table 14. Distance (miles) between mean centers of activity of related fallow deer, Land Between the Lakes, Kentucky.

Composition	Number of Pairs	Time Period	Mean Distance in Miles (Range in Parentheses)		
			Offspring As Fawns	Offspring As Yearlings	Offspring As Adults
Does and Doe Fawns	3	11/71	0.14(0.04-0.25)[a]		
		12/71	0.02(0.01-0.03)[a]		
		1/72	0.07(0.03-0.11)[a]		
		2/72	0.06(0.05-0.08)[a]		
		3/72	0.08(0.07-0.08)[a]		
		4/72	0.03(0.02-0.03)[a]		
		5/72	0.02[b]		
		Average Distance	0.06		
		1/72-5/73		0.15(0.00-1.06)	
		4/73-8/73			0.17(0.01-0.49)
Does and Buck Fawns	3	11/71	0.06[b]		
		12/71	0.03(0.00-0.06)		
		1/72	0.06(0.03-0.07)		
		2/72	0.12(0.03-0.28)		

Table 14. Continued

Composition	Number of Pairs	Time Period	Offspring As Fawns	Offspring As Yearlings	Offspring As Adults
			Mean Distance in Miles (Range in Parentheses)		
Does and Buck Fawns	3	3/72	0.03(0.02-0.05)		
		4/72	0.11(0.08-0.15)		
		5/72	1.77(0.33-3.21)		
		Average Distance	0.25		

[a] For only two pairs.
[b] For only one pair.

Table 15. Percent of fallow deer utilizing each habitat type by month, Land Between the Lakes, Kentucky.

	Percent Observed											
	Month											
Habitat Type	J	F	M	A	M	J	J	A	S	O	N	D
Woods	8.7	4.9	10.8	9.1	9.8	7.7	7.9	6.8	10.4	14.6	4.4	6.5
Herbaceous Vegetation	60.8	59.5	50.6	67.7	69.7	74.3	80.7	80.4	62.2	37.0	60.7	64.4
Agricultural Crops	9.2	10.8	20.4	10.5	3.5	3.9	1.0	0.0	19.6	37.1	21.0	19.0
Roadsides	0.3	1.7	0.4	0.1	2.0	0.5	1.1	0.4	0.0	0.0	0.9	0.2
Honeysuckle	0.2	0.0	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Salt Lick	0.6	0.0	0.0	0.4	0.9	1.0	1.8	0.2	0.0	0.0	0.0	0.2
Water	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Corn Bait	13.4	18.9	12.4	6.6	4.9	2.2	1.8	4.5	0.0	1.1	8.5	4.4
Others	6.6	4.3	5.5	5.6	9.1	9.6	5.4	7.9	8.0	10.0	4.5	5.1
Total	99.8	100.1	100.3	100.2	100.2	99.8	99.7	100.2	100.2	99.8	100.0	99.9

Table 16. Percent of fallow deer observed in each habitat type by 4-hour periods, Land Between the Lakes, Kentucky.

	Time Period (Hours)					
Habitat Types	1 - 4	5 - 8	9 - 12	13 - 16	17 - 20	21 - 24
Woods	6.0	8.4	15.0	24.9	6.1	6.5
Herbaceous Vegetation	73.9	65.5	57.1	39.0	49.7	75.1
Agricultural Crops	9.7	11.9	18.7	24.4	14.0	9.0
Roadsides	0.3	1.3	0.5	0.0	0.4	0.4
Honeysuckle	0.0	0.3	0.0	0.5	0.0	0.1
Salt Lick	0.6	0.5	0.4	0.0	0.1	0.5
Water	0.0	0.0	0.7	0.0	0.0	0.0
Corn Bait	2.7	4.0	1.8	6.1	24.9	3.3
Others	6.8	8.1	5.6	5.1	4.8	5.1
Total Percent	100.0	100.0	99.8	100.0	100.0	100.0
Total Deer Observed	884	2,202	546	213	2,189	2,269

Table 17. Percent of fallow deer observed in each activity by habitat type, Land Between the Lakes, Kentucky.

	Percent Observed								
Habitat Type	Moving	Standing	Bedded	Feeding	Courting	Playing	Drinking	Others*	Total
Woods	42.3	26.6	17.7	3.0	0.0	2.0	0.0	8.5	100.1
Herbaceous Vegetation	11.7	5.4	6.5	68.4	0.1	0.2	0.0	7.8	100.1
Agricultural Crops	2.9	1.2	2.2	87.2	0.5	0.0	0.0	5.9	99.9
Roadsides	23.5	21.6	0.0	45.1	0.0	0.0	0.0	9.8	100.0
Honeysuckle	0.0	14.3	28.6	57.1	0.0	0.0	0.0	0.0	100.0
Salt Lick	3.4	0.0	0.0	96.6	0.0	0.0	0.0	0.0	100.0
Water	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0

*Part of the animals in the group were engaged in one type of activity while the others were engaged in another type.

Table 18. Mean weights (pounds) of fallow and white-tailed deer, Land Between the Lakes, Kentucky, 1971-1973.

	Adults				Yearlings				Fawns			
	Males		Females		Males		Females		Males		Females	
Year	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
1971	6	171.7	22	108.1	8	124.1	9	94.8	28	77.7	20	66.2
			(1)[a]	(149.0)								
1972	3	152.3	17	110.2	1	118.0	3	93.7	31	78.0	11	63.6
	(1)	(220.0)	(3)	(153.7)	(3)	(135.3)	(3)	(134.3)	(1)	(83.0)	(3)	(79.7)
1973	3	138.3	17	111.2	9	105.4	6	98.0	51	72.6	24	64.5
	(1)	(160.0)	(8)	(135.3)			(4)	(114.8)	(7)	(71.6)	(6)	(67.2)

[a] Numbers in parentheses refer to white-tailed deer.

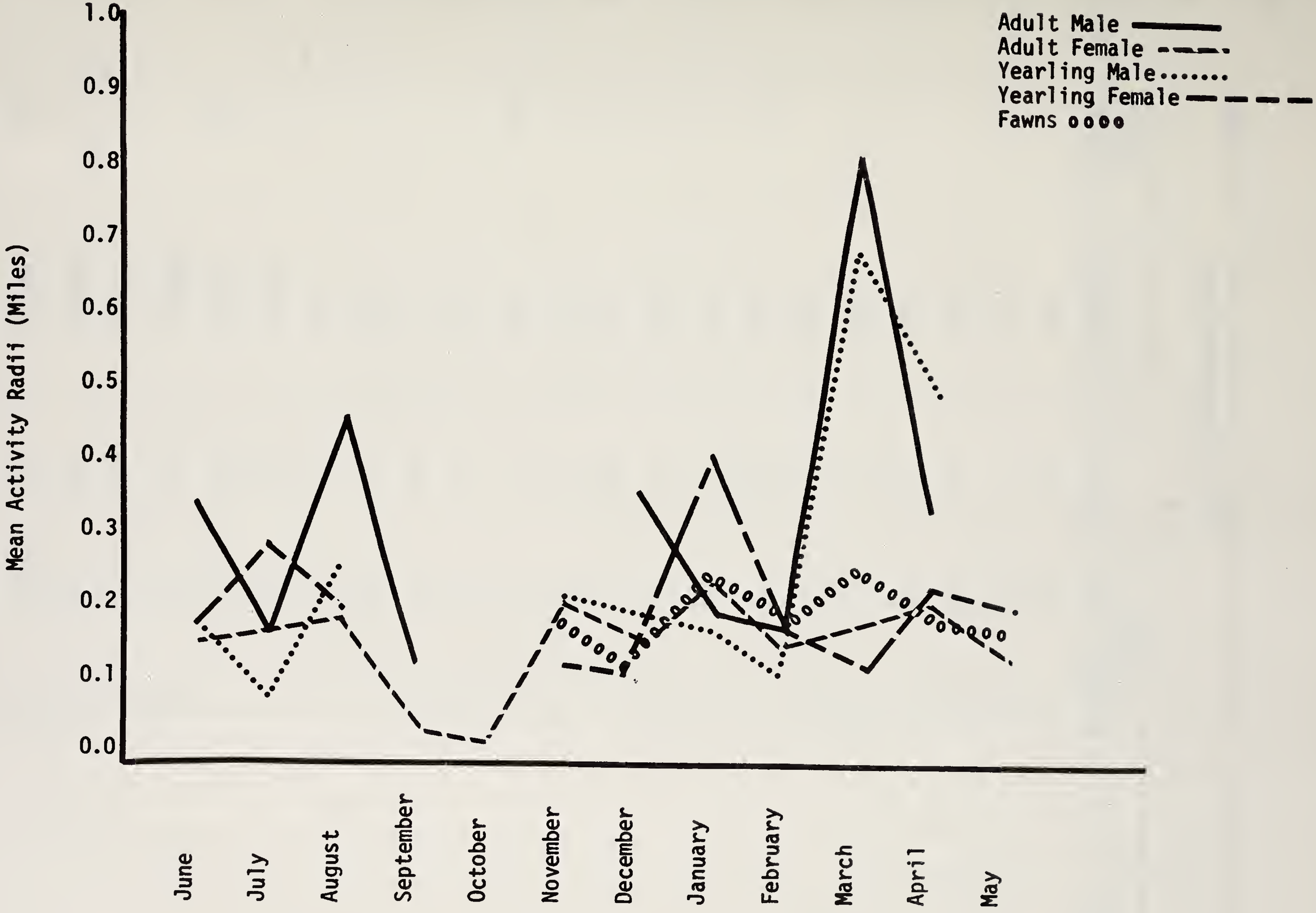

Figure 1. Mean activity radii (miles) by sex and age class by month for fallow deer, Land Between the Lakes, Kentucky.

Appendix A. Deer captured and marked on Land Between the Lakes-TVA area, January-December, 1971.

Collar Number	Streamer	Eartag	Males		Comments
			Age	Weight	
U	GLS	A11	1/2	85	
P	YLS	A2	1 1/2	120	
	WRS	A1	5-6	200	
X	RRS	A13	1/2	95	
Y	DBRS	A12	1/2	90	
	RLS	A10	5-6	161	
1Y	YRS	A25	1/2	91	
V	RLS	A28	1/2	94	
K	LBRS	A37	1/2	66	
N	PR	A27	1/2	91	
Q	DBL	A34	1/2	76	
1B	GR	A3	1/2	64	
S	WL	A14	1/2	90	
Z	PL	A19	1/2	81	
R	ORS	A21	1/2	81	
J	OLS	A24	1 1/2	131	
T	R&WRS	A26	1/2	78	
◆	G&WRS	A23	1/2	71	
+	DB&YRS	A46	1/2	80	
M	O&YRS	A43	1/2	82	
L	LB&YRS	A33	1/2	91	
1Q	LB&WRS	A42	1/2	86	
1H	R&WLS	990	1/2	86	

Appendix A. (Con't.)

Collar Number	Ear Streamer	Eartag	Males Age	Weight	Comments
	DB&WLS	989	3 1/2+	171	Lost tag & streamers
1C	P&DBLS	975	1 1/2	116	
▲	P&GLS	983	1/2	84	
■	Y&WLS	976	1/2	86	
		977	1/2	--	Killed, bow hunter, 10/16/71
	P&WR	2	1/2	38	
1J	LBL	3	1 1/2	115	
.155*	RLS	A28	1 1/2	130	Remarked w/ t'mitter
1N	O&GR	5	1/2	40	
.120*	W&DBR	994	2 1/2	160	
1U	Y&DGR	10	1/2	75	
1E	P&DBR	8	1/2	85	
1X	Y&OR	7	1/2	60	
1P	O&LBL	1	1/2	60	
.120*	ORS	9	3 1/2	168	Killed in state hunt
1S	R&LB	16	1 1/2	125	Capture mortality
.090*	G&R	15	1 1/2	130	Recapture for t'mitter
.305*	R&DB	19&20	4 1/2	170	
1K	G&RL	23	1 1/2	126	
1R	LB&W	32	1/2	70	

*Marked with radio-transmitter

Appendix A. (Con't.)

Collar Number	Ear Streamer	Eartag	Females		Comments
			Age	Weight	
2C		980	3 1/2+	117	
2K		991	1/2	66	
2A		993	3 1/2+	101	
3S		996	1/2	60	
2N		999	2 1/2+	95	
2V		998	1 1/2	85	
2B		992	1/2	70	
1A		979	6 1/2	148 1/2	White-tailed deer
2Z		978	2 1/2+	101	
2U		995	1/2	70	
2S		A52	1/2	76	
.180*		4	1 1/2	95	
2T		11	4 1/2	112	
2X		12	1/2	60	
2R		16	1/2	70	
.240*		13	6 1/2-7 1/2	107 1/2	
3A		005	5 1/2-6 1/2	120	Remarked
2Y		A53	1/2	46	
R		981	5 1/2?	111	
T		A51	1 1/2	95	
2L		A45	1/2	65	
.200*		A47	5 1/2-6 1/2	110	Remarked with t'mitter
3H		A49	1/2	61	
72		A9	3 1/2+	123	

Appendix A. (Con't.)

Collar Number	Ear Streamer	Eartag	Females Age	Females Weight	Comments
71		A8	1/2	76	
70		A6	1 1/2	100	
75		A4	1 1/2	102	
74		A5	2 1/2+	124	
77		A15	1/2	67 1/2	
79		A36	3 1/2+	105	
80		A29	3 1/2+	101	
81		A35	1 1/2	95	
82		A16	1/2	60	
89		A30	1/2	68 1/2	
84		A31	1/2	68 1/2	
85		A20	1 1/2	98 1/2	
87		A7	1/2	68 1/2	
88		A17	2 1/2	103 1/4	
90		A22	1/2	67 1/2	
94		A38	3 1/2	114	Blonde color
95		A32	1/2	73 1/2	
92		A26	2 1/2	116	
97		A39	3 1/2+	101	
98		A50	1 1/2	96	
93		A48	1/2	61	
99		988	2 1/2	101	
91		987	1/2	66	

Appendix A. (Con't.)

Collar Number	Ear Streamer	Eartag	Females Age	Females Weight	Comments
2P		975	3 1/2+	111	
2F		982	4 1/2+	97	
2H		985	1 1/2	86	
2J		977	3 1/2+	103	
2E		984	4 1/2+	103 1/2	

Appendix B. Deer captured and marked on Land Between the Lakes area, January-December, 1972.

Collar	Ear Streamer	Tattoo	Eartag	Sex	Age	Weight	Comments
3F			A40	F	4 1/2	110	
1W	W+OL		33	M	1/2	69	
1V	R+LBR		17	M	1/2	74	Black color; healed break of R hind foot
3K			24	F	6 1/2	114	
3I			A41	F	7 1/2	116	
4X	G+OL		27	M	1/2	80	
[illegible]	O+WR	R0013	31	M	1/2	90	
1Z	GL		28	M	1 1/2	126	WT
1L	RL		14	M	1 1/2	135	WT
4T	R+PR		26	M	1/2	89	
.230 Trans.			A44	F	3 1/2-4 1/2	101	Remarked, old 57 collar
3D			30	F	1/2	42	
3C			22	F	1 1/2	91	
3T			29	F	1 1/2	90	
3L			39	F	1/2	56	
3J			43	F	2 1/2	114	
4S	Y+PL		37	M	1/2	79	
3V			35	F	1/2	60	
3B			38	F	5 1/2	116	Black color
3M			42	F	1/2	71	
4Y	R+OL		41	M	1/2	85	
4A	G+LB		40	M	1/2	83	
4G			51	F	7 1/2±	151	WT

Appendix B. continued

Collar	Ear Streamer	Tattoo	Eartag	Sex	Age	Weight	Comments
4L			52	F	1 1/2	140	WT
4H			59	F	1/2	94	WT
4Z			55	F	1/2	80	WT
4B			54	F	2 1/2	155	WT
4U			53	F	1 1/2	143	WT
3Q			44	F	1/2	66	
3R			36	F	3 1/2	101	
4R	LB+GL		45	M	1/2	85	
3U			50	F	2 1/2	111	blond color
6F (duplicate)		R0038	379	M	1/2	75	solid white color
5B			A51	F	1 1/2	--	Replaced collar T
5Z			140	F	2 1/2	--	
5F			138	F	1 1/2	--	
5R			139	F	4 1/2	--	
.280 Trans.			106	F	8 1/2+	--	
5K			104	F	3 1/2	--	
5U			109	F	4 1/2	--	
5C			135	F	1/2	--	
.010 Trans.			143	F	5 1/2	--	
.060 Trans.	G+DBR	L0007	130	M	1/2	83	
6C		R0008	129	M	1/2	83	
4 ◆			128	M	1/2	83	
.325 Trans.			150	F	1/2	70	

Appendix B. continued

Collar	Ear Streamer	Tattoo	Eartag	Sex	Age	Weight	Comments
4N		L0011		M	1/2	--	Recap. and tatooed
5D			145	F	5 1/2-6 1/2	108	
5P			148	F	7 1/2-8 1/2	113	
.175 Trans.			144	F	7 1/2-8 1/2	111	
.160 Trans.	G+DBL	R0005	131	M	1/2	73	
30			125	F	1 1/2	100	
25			147	F	old	--	recap. and replaced eartags
5Y			149	F	4 1/2	98	
4J	Y+PR		58	M	1/2	73	Light color
4P	Y+RL		68 + 67	M	1/2	83	
4V			70 + 62	M	1/2	79	
4C			60 + 63	M	1/2	68	
4N			64 + 73	M	1/2	78	
5X			61	F	1/2	65	
4-			71 + 72	M	1/2	63	Black color
.220			69	M	1/2	78	Solid white color
X			74 + 75	M	1/2	83	WT
4Q	R+YR		65	M	1/2	84	
4F	G+YR		66	M	1/2	84	
4K	P+LB	L0012	47	M	1/2	86	
4W	O+PL		49	M	1/2	79	
4D	P+LBL	R0020	48	M	1/2	63	
4E	O+PR		46	M	1/2	80	tag lost in Duncan Creek

Appendix B. continued

Collar	Ear Streamer	Tattoo	Eartag	Sex	Age	Weight	Comments
3Z			25	F	4 1/2	113	
3P			56	F	1/2	67	
3Y			34	F	1/2	73	
3G			57	F	4 1/2	108	
6L		L0021	76	M	1/2	80	
5I			105	F	1/2	55	
6K		R0002	121	M	3 1/2	150	Recap. & Remarked
5M			77	F	1/2	75	
4+		0022	81	M	1/2	70	
5G			78	F	2 1/2	115	
7H			119	F	8 1/2±	110	
6B		R0019	117	M	2 1/2	145	
5L			118	F	8 1/2±	115	
1K	R+GL	R0003	23	M	1 1/2	118	
6A	O+DBR	R0004	127	M	4 1/2	162	Palmed antlers
--	RLS		A10	M	6 1/2-7 1/2	--	Capture Mortality
6Y		R0018	116	M	1/2	70	
4▲		R0014	113	M	1/2	--	
7I			111	F	1 1/2	--	
6V		L0015	132	M	1/2	--	
6E		R0016	124	M	1/2	--	
4●		L0017	110	M	1/2	--	
7L			107	F	1 1/2	--	

Appendix B. continued

Collar	Ear Streamer	Tattoo	Eartag	Sex	Age	Weight	Comments
5E			126	F	1/2	--	
5A			136	F	1/2	--	
3X			146	F	1/2	--	
6N			137 + 134	M	1/2	--	
3F			141	F	1/2	--	
6D		L0035	142	M	1/2	70	
4[illegible]		0036	103	M	1 1/2	145	WT
1S		0037	123	M	4 1/2	220	WT
6G			125	F	1/2	65	WT
6R			102	F	1 1/2	120	WT
6F			120	F	5 1/2	155	WT
6S		R0039	384	M	2 1/2	--	WT

Appendix C. Deer captured and marked on Land Between the Lakes-TVA area, January-August, 1973.

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
7E		386R	F	1/2	56	
6I	0040	376L	M	1/2	60	
5H		346L	F	2 1/2	110	
--	0041	377R	M	1 1/2	--	White-tail
5F			F	2 1/2		Recap. & Release
89			F	2 1/2		Recap. & Release
6O		396R	F	1/2	75	White-tail
6M		397R	F	1 1/2	115	White-tail
6R		390R	F	3 1/2	125	White-tail
6W		395R	F	7 1/2	157	White-tail
7C		144R	F	8 1/2	100	Remarked-t'mitter removed
6U	0042	80R	M	1/2	61	
6Q	0044	344R	M	1/2	52	
7S		382R	F	1/2	55	
6P	0043	378R	M	1/2	60	
7M		101R	F	6 1/2	111	
6H	0046	108L	M	1 1/2	95	
9A	0047	79R	M	1/2	78	
9H	0048	112R	M	1/2	84	
9F	0049	122L	M	1/2	77	
9D	0050	115R	M	1/2	85	
7R		113R	F	1/2	74	
9X	0057	349R	M	1 1/2	109	

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
7T		341R	F	1/2	75	
6T	0053	388R	M	1/2	67	
7V		348L	F	1/2	70	Black color
5J		387R	F	6 1/2+	107	
9N	0056	399R	M	1/2	80	
6Q			M	1/2		Recap. & Relaese
6U			M	1/2		Recap. & Release
5R			F	4 1/2		Recap. & Release
7U		343R	F	1/2	65	
7J		380R	F	1/2	59	
9P	0051	393R	M	1/2	82	
6X	0052	342L	M	1/2	70	
6Z	0054	114R	M	1/2	65	
7Q		391R	F	2 1/2	100	
9C	0055	398R	M	1/2	50	
5V		392R	F	1/2	60	
5S		383R	F	2 1/2	100	
9U	0058	394R	M	1/2	76	Black
9S	0059	350L	M	1 1/2	95	Replaced right eartag
9T	0060	347R	M	1/2	68	
9K	0061	400R	M	1 1/2	105	
9Y	0062	345R	M	1/2	70	
9E	0063	389R	M	1 1/2	105	

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
9V	0064	381R	M	1/2	75	
9L	0065	325R	M	3 1/2	132	
9R	0067	319R	M	1/2	79	
9G	0068	318R	M	1 1/2	102	
90	0070	303R	M	1/2	80	
9B	0071	304R	M	1/2	76	
7A		322R	F	1/2	70	
--*	0072	385R	F	1/2	73	Marked w/ t'mitter 1689
9W		308L	F	4 1/2	158	White-tail
Q1		307R	F	1/2	61	White-tail
A1	0073	321L	M	1/2	75	White-tail
7Y		331R	F	1/2	67	
■ Red*	0074	335L	M	1/2	77	Marked w/ t'mitter 1686
■ Yellow*	0008	129R	M	1 1/2	--	Marked w/ t'mitter 1702
9M	0076	340R	M	1/2	80	White-tail
9Z	0075	333R	M	1/2	71	White-tail
B1		336R	F	1/2	75	White-tail
D1		301R	F	1/2	77	White-tail
4H		59R	F	1 1/2	116	White-tail; recap.
4B*		54R	F	5 1/2	148	White-tail; collar removed for t'mitter 1703 placement
8F		327R	F	6 1/2	115	

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*Marked with radio-transmitter.

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
8X		339R	F	8 1/2	115	
8C		334R	F	10 1/2+	100	
8N		320R	F	3 1/2	102	
F1	0083	329R	M	1/2	65	
S1	0082	326R	M	1/2	71	Cyst on left side
7D		313R	F	5 1/2	103	
5T		311R	F	1 1/2	91	
N1	0084	309R	M	1/2	75	
7N		332R	F	1/2	74	
01	0081	315R	M	1/2	79	
Y1	0077	302R	M	1/2	82	
7P		A54R	F	1/2	71	
9Q	0078	330R	M	1/2	74	
R1	0079	312R	M	1/2	74	
G1	0080	337R	M	1/2	80	
■ Green*	0085	317R	M	1/2	70	Marked with t'mitter 1687
8R		306R	F	1/2	65	
Z1	0086	328R	M	1/2	74	
--	1111R & L		M	1 1/2	117	Placed in deer pen
--	2222R & L		F	1 1/2	107	Placed in deer pen
H1	0088	366R	M	1/2	76	
U1		365R	F	1 1/2	112	White-tail

*Marked with radio-transmitters.

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
8L		362R	F	1/2	47	
7B		324R	F	6 1/2	100	
V*	0089	353R	M	2 1/2	133	Recap.; replaced tag A28 with 353; marked with t'mitter .155
8Z		361R	F	3 1/2	109	
M1	0095	371R	M	1/2	79	
K1	0097	372R	M	1/2	77	
V1	0098	323R	M	1/2	75	
W1	0091	316R	M	1/2	77	
--*	0092	375R	M	1/2	81	Marked with t'mitter .040
X1	0093	370R	M	1/2	85	
P1	0094	374R	M	1/2	78	
8T		305R	F	1/2	61	
8P		356R	F	1 1/2	103	
T1	--	354R	M	1/2	77	
8E		373R	F	1/2	63	
M2		360R	F	1/2	50	White-tail
T2		368R	F	1 1/2	116	White-tail
H2	0100	363R	M	1/2	64	White-tail
E1	0101	351R	M	1/2	62	White-tail
C1		367R	F	8 1/2+	127	White-tail
N2	0102	12R	M	1/2	74	White-tail

*Marked with radio-transmitter.

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
X2	0103	11R	F	5 1/2	127	White-tail
--	3333R & L		M	1 1/2	103	Placed in deer pen
U2	0104	314R	M	1/2	86	
Y2	0105	369R	M	1/2	76	
L2	0106	358R	M	1 1/2	118	
9Y			M	1/2		Recap. & Release
6Z			M	1/2		Recap. & Release
--*		364R	F	1/2	66	Marked w/ t'mitter .025
F2	0107	355R	M	1/2	52	
9T			M	1/2		Recap. & RElease
A2	0108	14R	M	1/2	73	
--*	0110	21R	M	3 1/2	150	Stranger to area; marked with t'mitter 1701
--*		338R	F	1 1/2	102	Marked w/ t'mitter .000
9A*	0047	79R	M	1/2	--	Remarked; t'mitter .135
6J	0111	359R	M	4 1/2	160	White-tail
4G*		51R	F	7-8 1/2	110	White-tail; Remarked; t'mitter .180
8A		357R	F	1/2	65	
--*		310R	F	1/2	62	Marked w/ t'mitter .265
8D		D79R	F	1/2	69	
8I		D91R	F	1/2	73	
6P			M	1/2		Recap. & Release
--*	0112	D92R	M	1/2	87	Marked w/ t'mitter .090

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*Marked with radio-transmitter.

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
8K		D89R	F	1/2	43	
S2	0113	D85R	M	1/2	85	
old 25*		147L	F	A	111	Recap.;marked w/ t'mitter .100
7J			F	1/2		Recap. & Release
--	4444R & L		F	2 1/2	127	Placed in deer pen; white-tail
8B		D78R	F	1/2	72	
8H		D80R	F	1/2	74	
71		D76L	F	2 1/2		Recap.; replaced eartag
old 2R*		6R	F	1 1/2	95	Recap.; marked w/ t'mitter .075
2Z			F	3 1/2		Recap. & Release
R2	0148	D93R	M	1/2	75	White-tail
G2		D90R	F	2 1/2	130	White-tail
P2		D87R	F	1/2	65	White-tail
12		LBL188 D96L	F	4 1/2	131	Recap.
old 41		184R A47L	F	A	150	Recap.
Y2			M	1/2		Recap. & Release
8G		D88R	F	1 1/2	90	
D2	1358	D84R	M	1/2	47	
C2	2358	D77R	M	1/2	51	
8M		D86R	F	1/2	42	

Appendix C. (Con't.)

Collar	Tattoo	Eartag	Sex	Age	Weight	Comments
7R			F	1/2		Recap. & Release
2B			F	2 1/2		Recap. & Release

BOUND BY
HNM
5-94